

# Status of Air Quality in Central California and Needs for Further Study

Saffet Tanrikulu, Ph.D.

Research and Modeling Manager

Bay Area Air Quality Management District

4<sup>th</sup> ACAST Meeting

Sacramento, CA

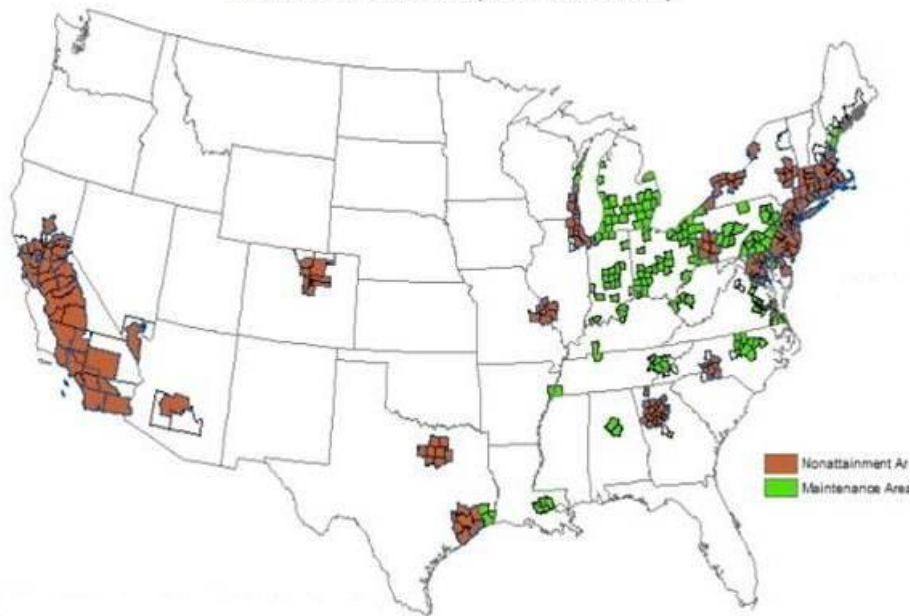
November 29-30, 2012

# Status of Air Quality in Central California

- One of the most polluted areas in the US
- Need to reduce emissions by 60% to achieve regulatory attainment
- Cost-effective emission reductions have been made
- Additional emission reductions are costly or require new technologies
- Our goal is to improve the accuracy of air quality models and forecast to better help planners

# Nonattainment Areas for Ozone and PM<sub>2.5</sub> in the US

8-Hour Ozone Nonattainment and Maintenance Areas (1997 Standard)



PM<sub>2.5</sub> Nonattainment Areas (2006 Standard)



# Balanced Pollution Control Strategies

- Assess accurately of air quality benefits for new emission controls
- Develop incentive programs when exceedances are forecast
  - Free transit days
  - Telecommuting
  - Bike to work

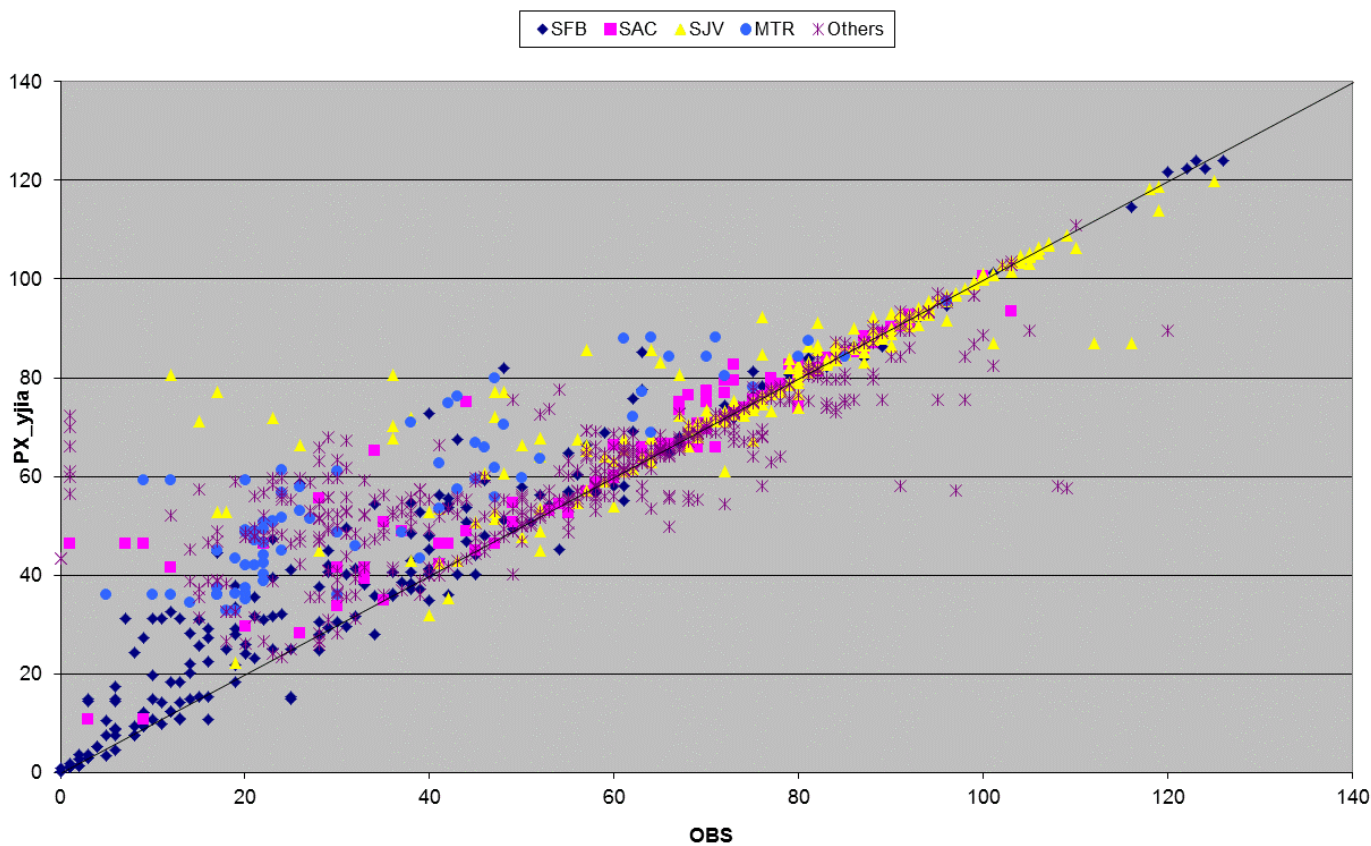
Improved air quality model performance and forecast is critical for these strategies to succeed

# Current Research at BAAQMD

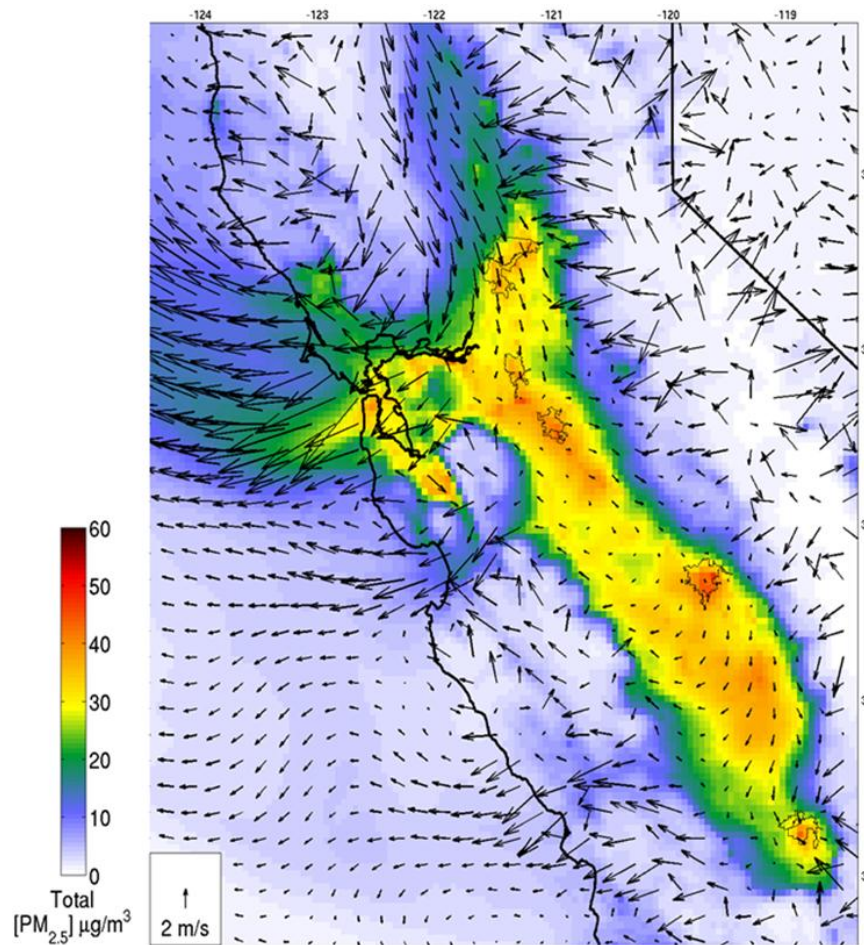
- Ozone modeling
- PM<sub>2.5</sub> modeling
- Toxic substance modeling
- Wood smoke modeling
- Ultrafine PM modeling
- Health benefit analysis of PM<sub>2.5</sub> reduction
- Health benefit analysis of ultrafine PM reduction
- Statistical analyses to identify conducive days for adverse air quality

# Ozone Simulation Using WRF-CMAQ

O3 PX\_yjia vs OBS 13-20 PDT 07-31-2000 (Camx ICBC 5x5+time)

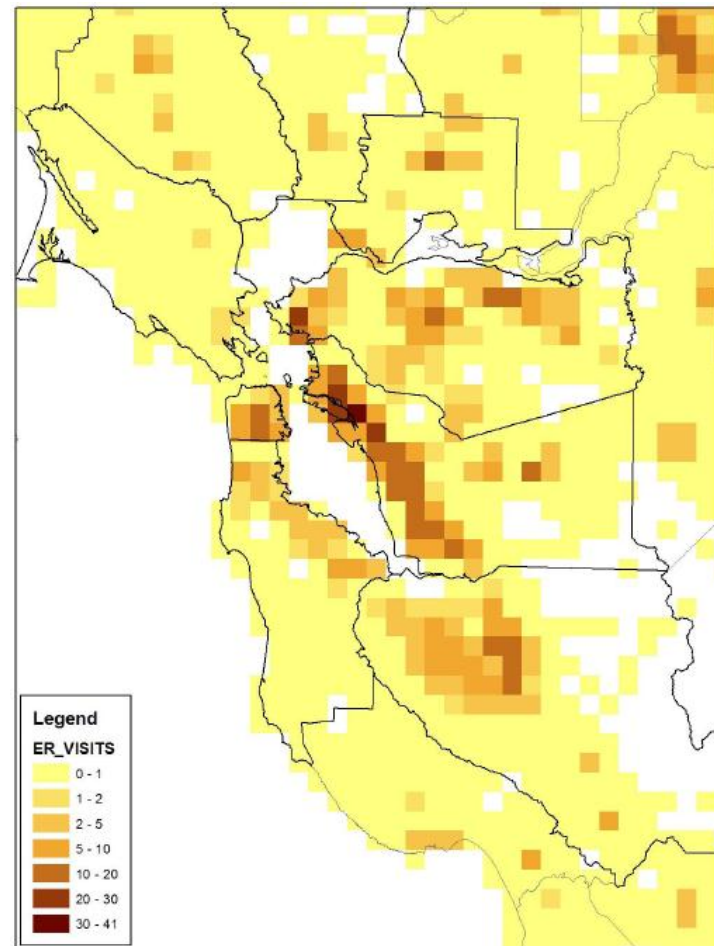


# PM<sub>2.5</sub> Simulation Using MM5-CMAQ

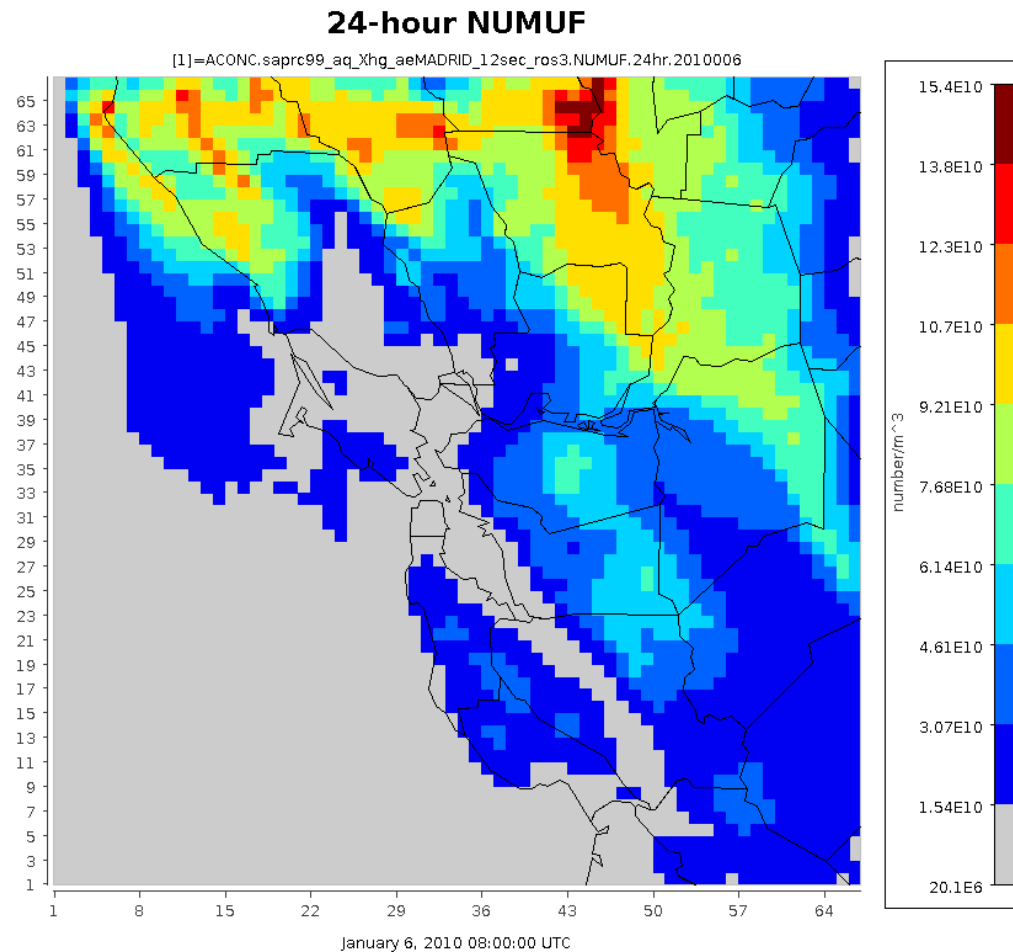


# Heath Benefit Analysis Using BenMAP

Reduced number of asthma-related emergency room visits per 10,000 people under 18 years as PM<sub>2.5</sub> is reduced from 2010 levels to the background level (5  $\mu\text{g}/\text{m}^3$ ).



# Ultrafine PM Simulation Using WRF-Amsterdam2 (12 sectors)



# Proposed AQAST Investigator Projects

1. Analysis of weather patterns impacting Central California ozone using satellite cloud cover data
2. Improve meteorological models using satellite data
3. Improve ozone and PM2.5 forecasts of the National Air Quality Forecast System over Central California
4. Using satellite data to help manage PM2.5 in the San Francisco Bay Area

# Analysis of Weather Patterns Impacting Central California Ozone using Satellite Cloud Cover Data

PI: Richard McNider

- Providing a conceptual description linking upwind marine conditions over the Pacific Ocean to ozone formation in Central California
  - Improving ozone forecasting
- Evaluating meteorological and air quality models against the conceptually described marine conditions
  - How well do models estimate cloud cover

# Cloud View on a Non-exceedance Day

At Orinda BART Station Looking Toward West



BAY AREA  
AIR QUALITY  
MANAGEMENT  
DISTRICT

# Cloud View on an Exceedance Day

At Orinda BART Station Looking Toward West



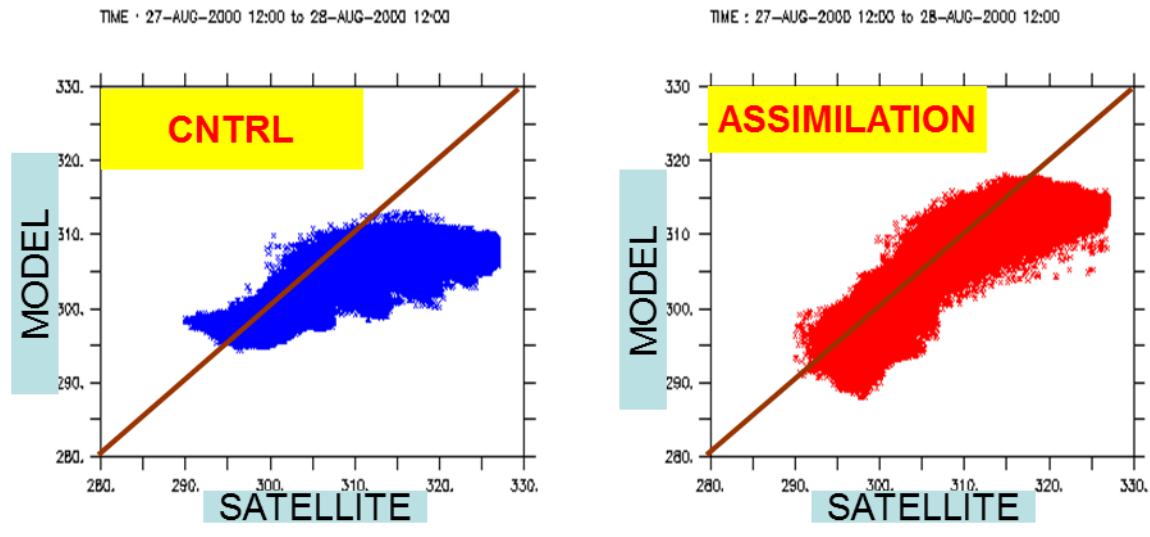
BAY AREA  
AIR QUALITY  
MANAGEMENT  
DISTRICT

# Improve Meteorological Models using Satellite Data

PI: Richard McNider

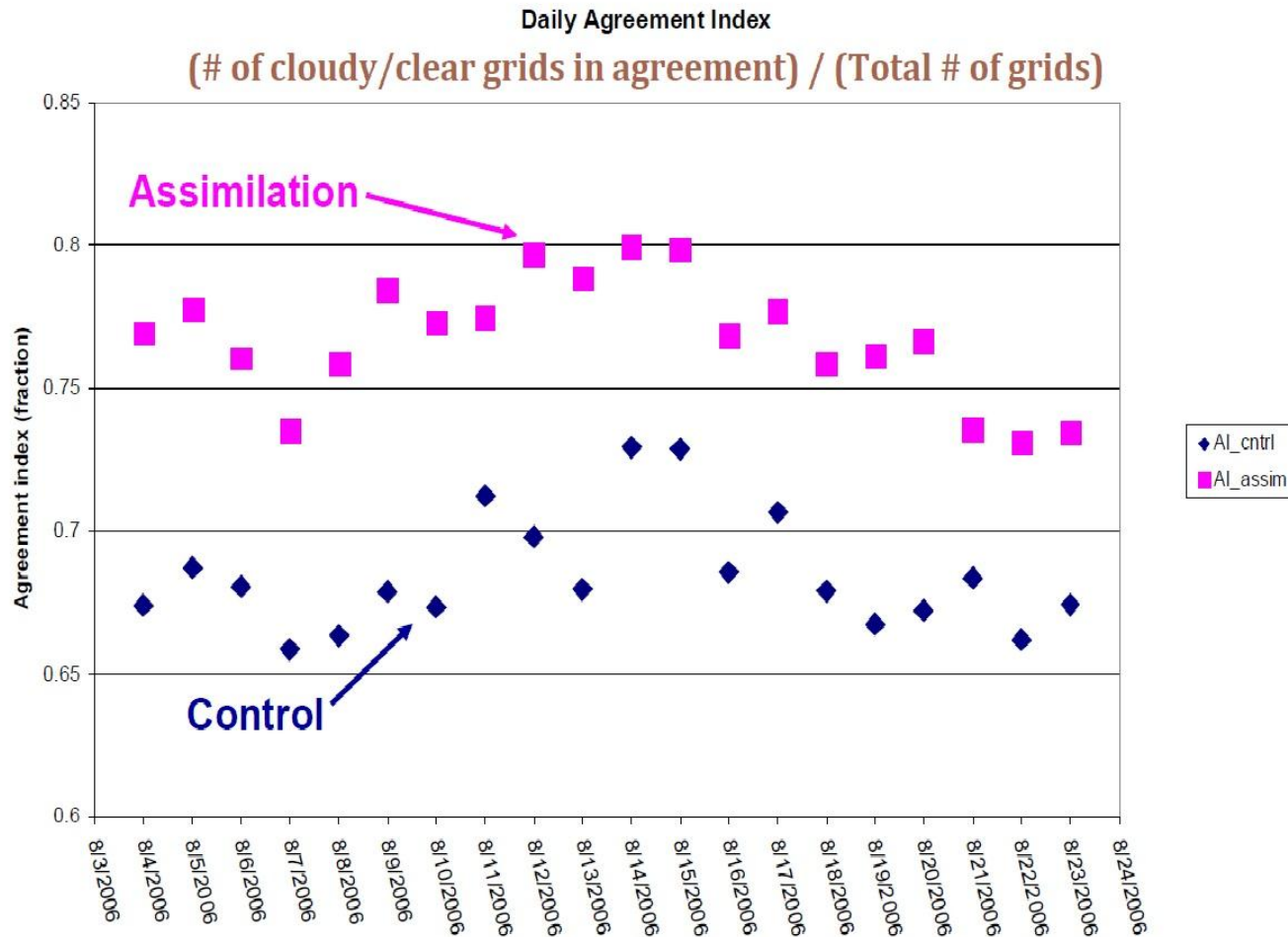
- Adopt UAH's dynamic cloud adjustment and surface temperature assimilation methods for Central California applications
- Improve performance of regulatory air quality models by improving meteorological model performance
  - Significant improvements are expected because currently limited data are available over the Pacific Ocean

# Effect of Land Surface Temperature Assimilation



Adapted from slides provided by Dr. Biazar

# Effect of Dynamic Cloud Adjustment



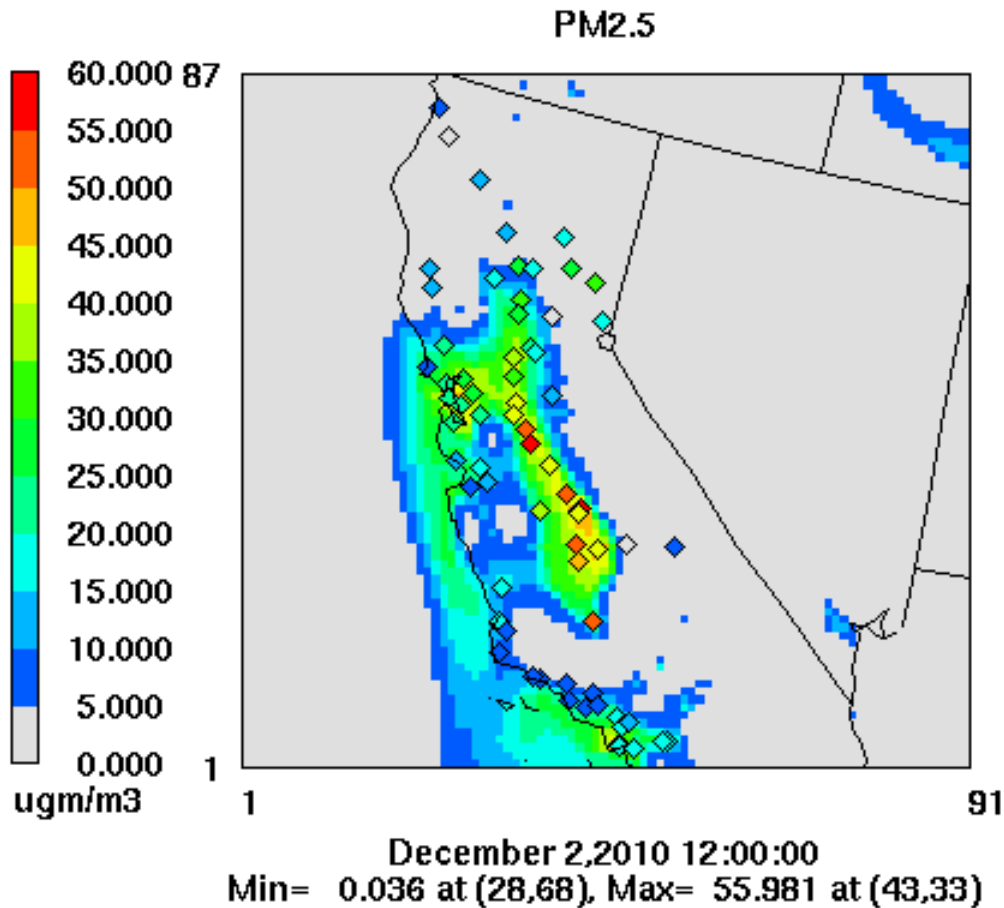
Adapted from the 2012 CMAS presentation by Park, Biazar, McNider, Dornblaser, Khan and Doty

# Improve Ozone and PM2.5 Forecasts of the National Air Quality Forecast System over Central California

PI: Puis Lee

- Perform comprehensive model evaluation on local scale
- Provide feedback to NOAA for model improvements
- Promote the use of modeled forecast by local agencies

# National Air Quality Forecast System



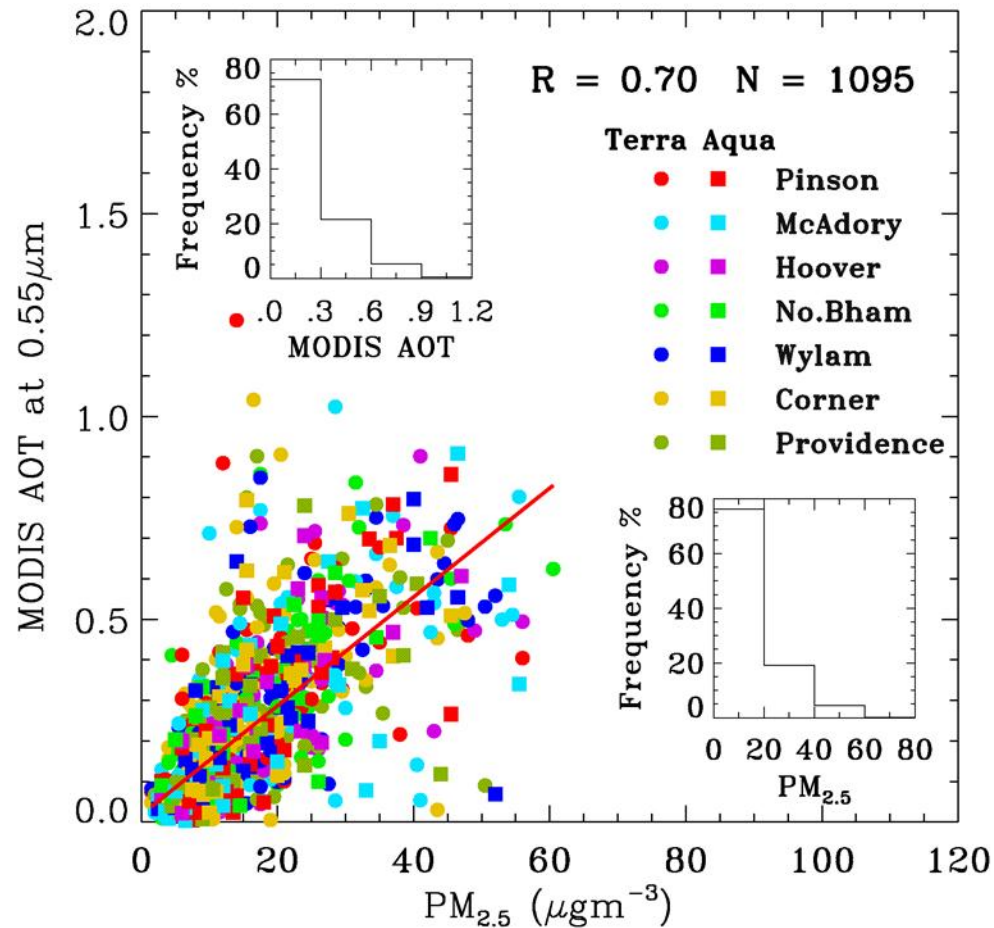
NAQFS data provided by Dr. Pius Lee

# Using Satellite Data to Help Manage PM2.5 in the San Francisco Bay Area

PI: Yang Liu

- Monitor PM2.5 at subregions
- Identify heavily polluted areas
- Assess trend in PM2.5 concentrations
- Evaluate air quality modeling (CMAQ) results at subregional level

# MODIS AOT vs. Observed PM<sub>2.5</sub> over Northern Alabama for 2002



Adapted from slides provided by Prof. Jun Wang  
of University of Nebraska - Lincoln